Natural Events Policy Documentation of a Natural Event Due to High Winds on 29-Sep-2005 Kennewick, WA

Benton Clean Air Authority

February 14, 2006

OVERVIEW

On September 29, 2005, the PM10 High Volume FRM (Federal Reference Method) and the PM10 Tapered Element Oscillating Microbalance (TEOM) FRM in Kennewick, Washington measured concentrations of particulate matter 10 microns and smaller in size (PM_{10}) of 245 and 268 $\mu g/m^3$, respectively. These concentrations exceeded the primary 24-hour PM_{10} National Ambient Air Quality Standard (NAAQS) of 150 $\mu g/m^3$. The primary contributor to the exceedance was identified as fallowed wheat fields, recently harvested irrigated agricultural fields, and to a lesser extent, localized urban areas, which were subjected to high wind speeds. An exact quantification of the source contributions is not available. The Benton Clean Air Authority (BCAA) believes that the 29-Sep-2005 event is a "natural event" in accordance with the EPA Natural Events Policy.

NATURAL EVENTS POLICY

The Natural Events Policy (NEP) was issued in May 1996 to provide an avenue of response to PM_{10} air quality data that are due to uncontrollable natural events. Under NEP provisions, PM_{10} attributable to a natural event can be excluded from an attainment or non-attainment decision. The NEP is applicable when PM_{10} data is due to uncontrollable natural events and the dust originates from non-anthropogenic sources or from contributing anthropogenic sources controlled with best available control measures (BACM).

The two basic requirements of the NEP are:

1) The states must develop a Natural Events Action Plan (NEAP) to deal with future PM_{10} NAAQS exceedances.

2) The states must also establish a clear and casual relationship between the observed natural event and the observed exceedance and document the event.

WASHINGTON STATE'S COLUMBIA PLATEAU WINDBLOWN DUST NATURAL EVENTS ACTION PLAN

Washington State's Natural Events Action Plan (NEAP) to address PM_{10} from natural events occurring in the Columbia Plateau region of eastern Washington was a result of a large number of PM_{10} NAAQS exceedances in this region in the period from the late 1980's and early 1990's. Agricultural fields upwind of PM_{10} monitoring sites were identified as the principal sources of windblown dust. The Washington State Department of Ecology's Air Quality Program developed the initial NEAP in 1998 and updated the document in 2003.

The NEAP has several purposes:

- Development of procedures for taking appropriate, reasonable measures to safeguard public health when natural events occur.
- Responsibility to assure that emission controls are applied to sources that contribute to exceedances of the PM_{10} NAAQS, when those controls will result in fewer violations of the standards. Emission controls include BACM development and implementation.
- Authorization for documentation to be submitted to request designation of an exceedance of the NAAQS for PM_{10} as being the result of a natural event.

Definition of High Wind Event in NEAP

The 2003 NEAP refined the definition of high wind event for Washington State in accordance with the provisions of the NEP allowing the states to determine this definition. This provision recognizes the multiple variables that affect the wind erosion processes that result in windblown dust and the generation and transport of PM_{10}, which geographically differs. Following is the definition of a "high wind event" from pages A1-A4 of the Washington State Columbia Plateau Windblown Dust Natural Events Action Plan (Ref 11):

"A high wind event occurs when the wind entrains and suspends dust to the extent that concentrations of PM_{10} are elevated. This occurs when the average hourly wind speed at 10m is 18 miles per hour or greater for two or more hours [18+2], or in excess of 13 [13+2] miles per hour for two or more hours when conditions of higher susceptibility to wind erosion exist (see attachment A1). A high wind event that exceeds PM_{10} standard is a natural event."

This definition recognizes the concept that the wind speed threshold for wind erosive processes on soil to cause elevated PM_{10} concentrations in the air is variable. This variability depends on multiple variables related to soil characteristics, wind gustiness, soil surface residue cover, moisture content, and others. Attachment A1 to Appendix A of the Columbia Plateau NEAP documents the research and explains the logic behind this two-stage "high wind event" definition. The high wind event definition also necessarily includes the concept that the intensity of the wind event is a combination of wind speed and significant duration (sustained wind).

Relationship of High Wind Event Definition to Documentation

The amount of detail in the event documentation required by the NEAP varies with the category (18 mph for ≥ 2 hr; or 13 mph for ≥ 2 hr under higher wind erosion

susceptibility) of high wind event definition. For the "18 + 2" category the documentation burden is less because of the more clear-cut association of the observed PM_{10} data and the wind speed profile. The wind speed profile contains wind speed, wind direction, and duration and essentially is a data plot of wind speed and direction against a period of time. Precipitation preceding the day of the event is also part the "18 + 2" data set. The higher wind speed event more easily meets the "clear and causal" criteria of the Natural Events Policy.

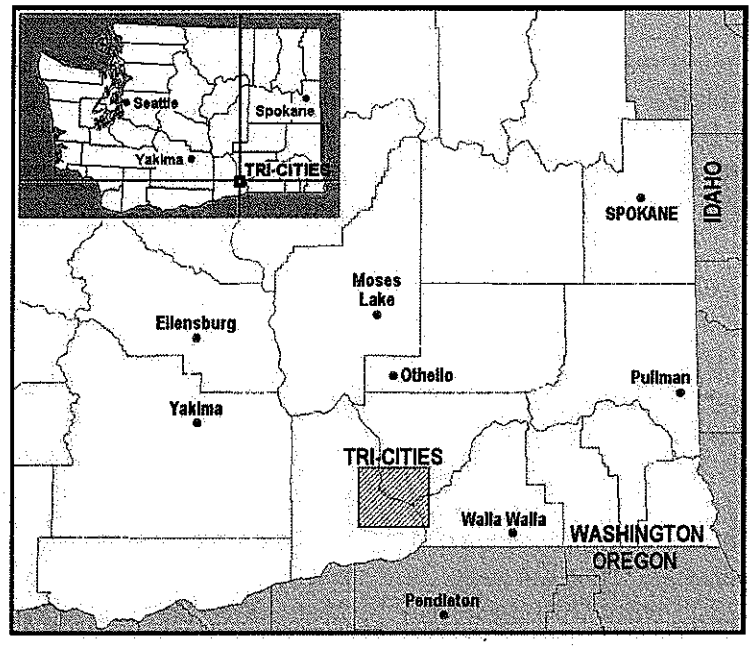
The "13 + 2" category within the high wind event definition is more complex with respect to establishing the link between the wind event and elevated PM_{10}. The meteorological phenomena driving the process are spatially and temporally more complex and the number, geographic distribution and complexity of the meteorological measurements needed to describe the event are greater. These complexities may require more sophisticated methodology to reveal the dynamics of the event. Regional scale meteorological modeling coupled with PM_{10} generation (emission) and transport modeling may be necessary and other data may be needed to link an event to remote source areas.

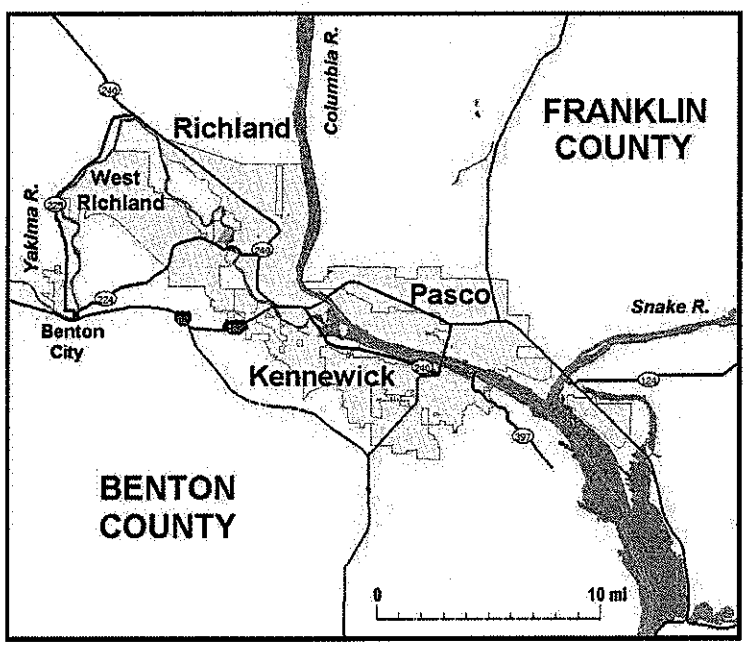
GENERAL DESCRIPTION OF AREA

Kennewick, Richland (including West Richland), and Pasco, known collectively as the Tri-Cities, are located in southeast Washington where the Yakima, Columbia, and Snake Rivers meet (Figure 1). The eastern half of the State of Washington lies in the rain shadow of the Cascade Mountains making the region a semi-arid desert. Average annual precipitation in the Tri-Cities region is about 6-7 inches with high rainfall intensity being very uncommon. Irrigated agriculture produces a wide diversity of crops including fruits, vegetables, alfalfa and potatoes. Dryland (non-irrigated) wheat production compliments the irrigated cropping systems. Large areas of non-agricultural range and desert lands complete the major land use areas of the region.

The Tri-Cities are located in an open-ended river basin partially bounded by low hills to the south and southwest. The terrain coupled with prevailing south and west winds limit local stagnant air pollution by ventilating the area. This coupling can also produce some extraordinary wind speeds and patterns. These winds can produce significant wind erosion events that can blanket the Tri-Cities region with dust from vulnerable agricultural fields and other areas. On rare occasions, usually during the fall and winter, strong winds can occur from the north and northwest sectors.

Figure 1: The Tri-Cities Area





EVALUATION OF 29-SEP-2005 EVENT

This section describes the major factors that affected the occurrence of the windblown dust event and an exceedance of the PM_{10} NAAQS on 29-Sep-2005 in Kennewick, WA. Analysis of the high wind event summarizes the circumstances and characteristics of the event. Best available control measures (BACM) are reviewed to demonstrate compliance with the BACM requirement of the Natural Events Policy. Landscape stability conditions are described to show what factors on the land and the activities taking place contributed to the observed windblown dust PM_{10} NAAQS exceedance.

PM_{10} Data

The Kennewick PM_{10} High Volume federal reference method (FRM) monitor operates on a 1- in - 1 day schedule. In addition, a continuous PM_{10} Tapered Element Oscillating Microbalance (TEOM) has been operating since 1998 which EPA designated a PM_{10} FRM in July 2005. Tables A1 and A2 in Appendix A show Kennewick PM_{10} data for 2004 and data for January through 28-Sep-2005, respectively. The average PM_{10} High Volume FRM concentration for 2004 was 29.2 ug/m^3. The recorded exceedances of the PM_{10} NAAQS in 2005 were 205 ug/m^3 on 16-Mar-2005, and 590 ug/m^3 on 12-Aug-2005. The two exceedances from 2005 have been documented and submitted to EPA as natural events.

The 2005 average PM_{10} High Volume FRM concentration in the months prior to the 29-Sep-2005 exceedance was 28.6 ug/m^3. These daily PM_{10} values in Tables A1 and A2 (Appendix A) show that the days with 24-Hour PM_{10} concentrations that exceed the NAAQS are relatively rare and are much higher than the majority of daily values and other maximums for the period. The annual average PM_{10} concentration has not exceeded the annual NAAQS standard of 50 ug/m^3 in 18 years of monitoring at the Kennewick site.

Table 1 shows the occurrence of windblown PM_{10} exceedances, which have been documented as natural events since the inception of the NEP in May 1996. The BCAA takes principal responsibility for high wind events and natural events documentation for exceedances that affect primarily Benton County. Documentation of larger regional events that affect a greater area of the Columbia plateau including Benton County is the principal responsibility of the Washington State Department of Ecology's Air Program.

Table 1: History of Documented Windblown Dust Natural Events in Benton County (BCAA jurisdiction)

YEAR	DATE	CONCENTRATION (μg/m3)	ACTION TAKEN
1999	September 23	180	Ecology NEP[1]
1999	September 25	305	Ecology NEP[1]
2000	July 31	218	BCAA NEP[2]
2001	March 13	351	BCAA NEP[2]
2001	September 25	284	Ecology NEP[1]
2001	October 23	267	BCAA NEP[2]
2002	August 16	186	BCAA NEP[2]
2003	March 5	186	BCAA NEP[2]
2003	October 28	1438	Ecology NEP[1]
2003	November 10	164	BCAA NEP[2]
2004	March 18	301	BCAA NEP[2]
2004	April 27	539	Ecology NEP[1]
2005	March 16	205	BCAA NEP[2]
2005	August 12	590	BCAA NEP[2]

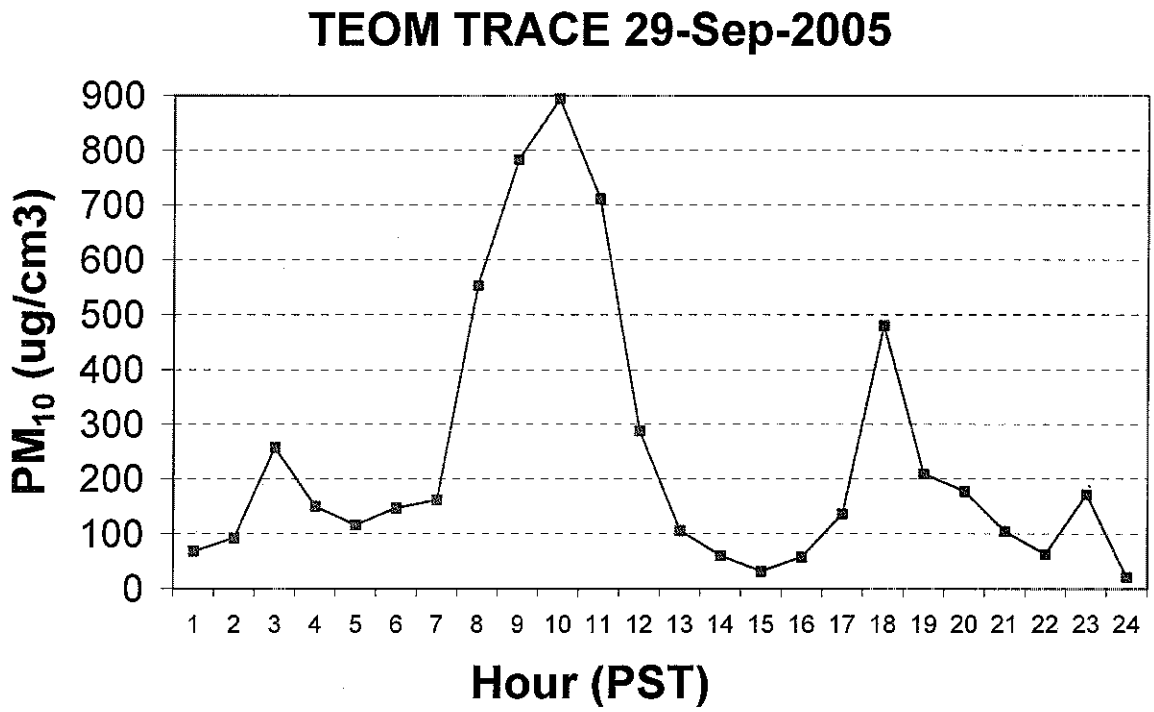
[1] Regional event with generalized dust storm conditions from a high wind event occurring in the intermountain region east of the Cascade Mountain range, which are documented by the Washington State Department of Ecology's Air Program

[2] Dust storm conditions from a high wind event that affected primarily Benton County documented by the Benton Clean Air Authority

PM_{10} Levels in Kennewick

PM10 concentrations rose sharply on 29-Sept-2005 between 0100 through 0900 PST and remain high for most of the day. By 2200 PST 29-Sep-2005, the PM_{10} levels had returned to near normal levels (Figure 2). The Kennewick SLAMS (State and Local Air Monitoring Station), had the only PM_{10} FRM's (Federal Reference Monitor) that was operating in the impacted areas of Eastern Washington, thus, Kennewick recorded the only exceedance of the PM_{10} NAAQS (National Ambient Air Quality Standard).

Figure 2:



High Wind Event Analysis

Synoptic Weather Pattern

The synoptic weather pattern provides the broad view of the weather systems that set up and drive the observed wind event. The positioning of high and low pressure areas with associated air mass circulation patterns and pressure gradients help in understanding the wind speeds, direction, duration, and shifting of winds that may occur during a wind event.

On 29-Sep-2005 a very organized, fast moving low-pressure system and corresponding cold front was beginning to make landfall on the Washington coast and a strong pressure gradient was developing across Washington State (Figure 3b). Because winds move from areas of higher pressure to lower pressure and the mass air movements are respectively counterclockwise and clockwise around lows and highs, strong winds began from the southwest towards the northeast at approximately 0900 (PST). During the course of the day, the low pressure system pushed closer to the weak highs, which were well established across the western United States. The resulting wind speeds were high enough to cause soil particles to become airborne and generate PM_{10}

emissions. These high, sustained winds continued until the early morning hours of 30-Sep-2005 when the low pressure system moved more inland over the north-central United States and high-pressure began to build in the Tri-Cities area (Figure 3c).

Figure 3 a-c: Synoptic Weather Maps

Figure 3a: 28-Sep-2005

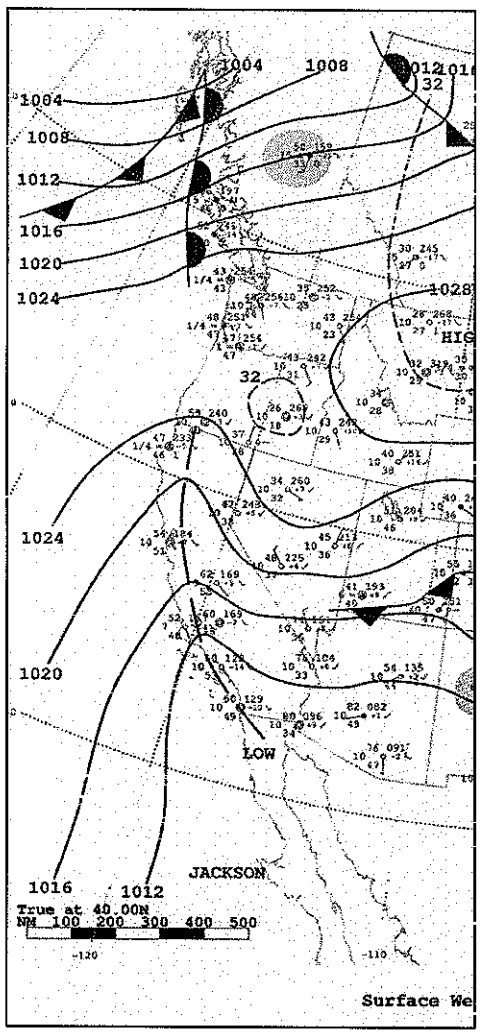


Figure 3b: 29-Sep-2005

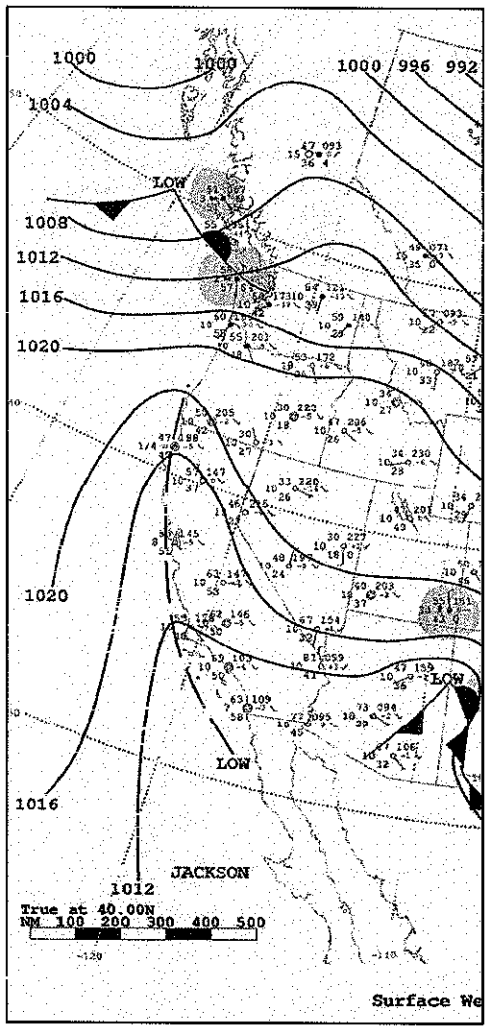
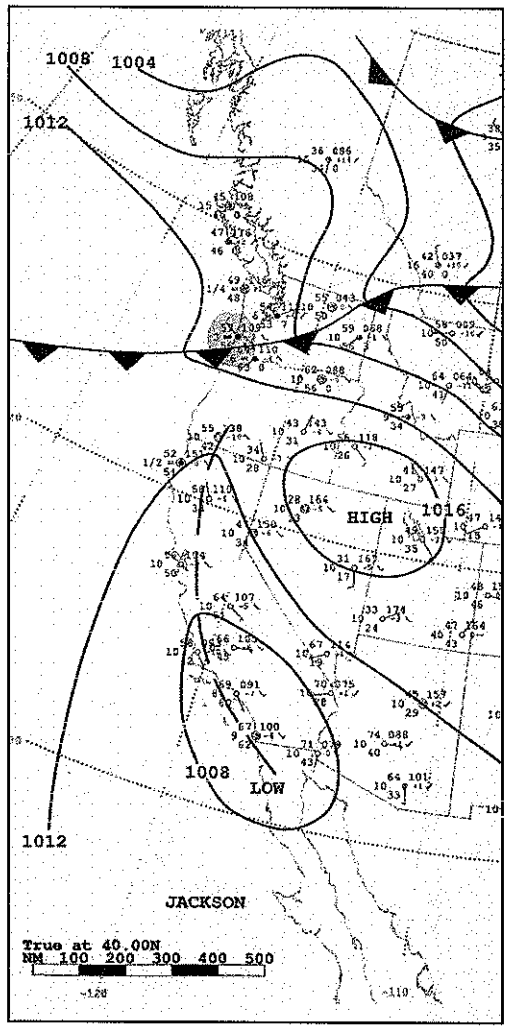


Figure 3c: 30-Sep-2005



Wind Data in the PM_{10} Source Area and the Urban Receptor Area

The following wind data shows in detail the manifestation of the larger scale synoptic circulation depicted in Figure 3. The wind direction for both urban and rural areas remained southwesterly for the duration of the highest wind speeds. Also for both areas, the wind speeds were more than sufficient for exceeding wind erosion thresholds and the wind travel (miles) was more than sufficient to accomplish transport of entrained PM_{10} generated in the wind erosion process.

Wind data was analyzed from the Public Agricultural Weather Station (PAWS) meteorological (MET) network in locations in Benton County (Figure 4a). Tables 2b and 2c show wind data from rural and urban MET stations to show the general trends of wind speeds and directions in these two areas from 2000 (PST) 28-Sep-2005 through 0000 (PST) on 30-Sep-2005.

In the rural PM_{10} source area of the Horse Heaven Hills dryland wheat growing area the wind speeds were above 18 mph for an extended period at Alderdale and Gramling. (Table 2b) in a steady southeasterly direction. The BCAA has observed this common or typical pattern on numerous dates for previous PM_{10} NAAQS exceedances. The rural PM_{10} source area meets the wind data standard of [18+2] miles per hour for two or more hours.

Figure 4a: Benton County Area PAWS Stations

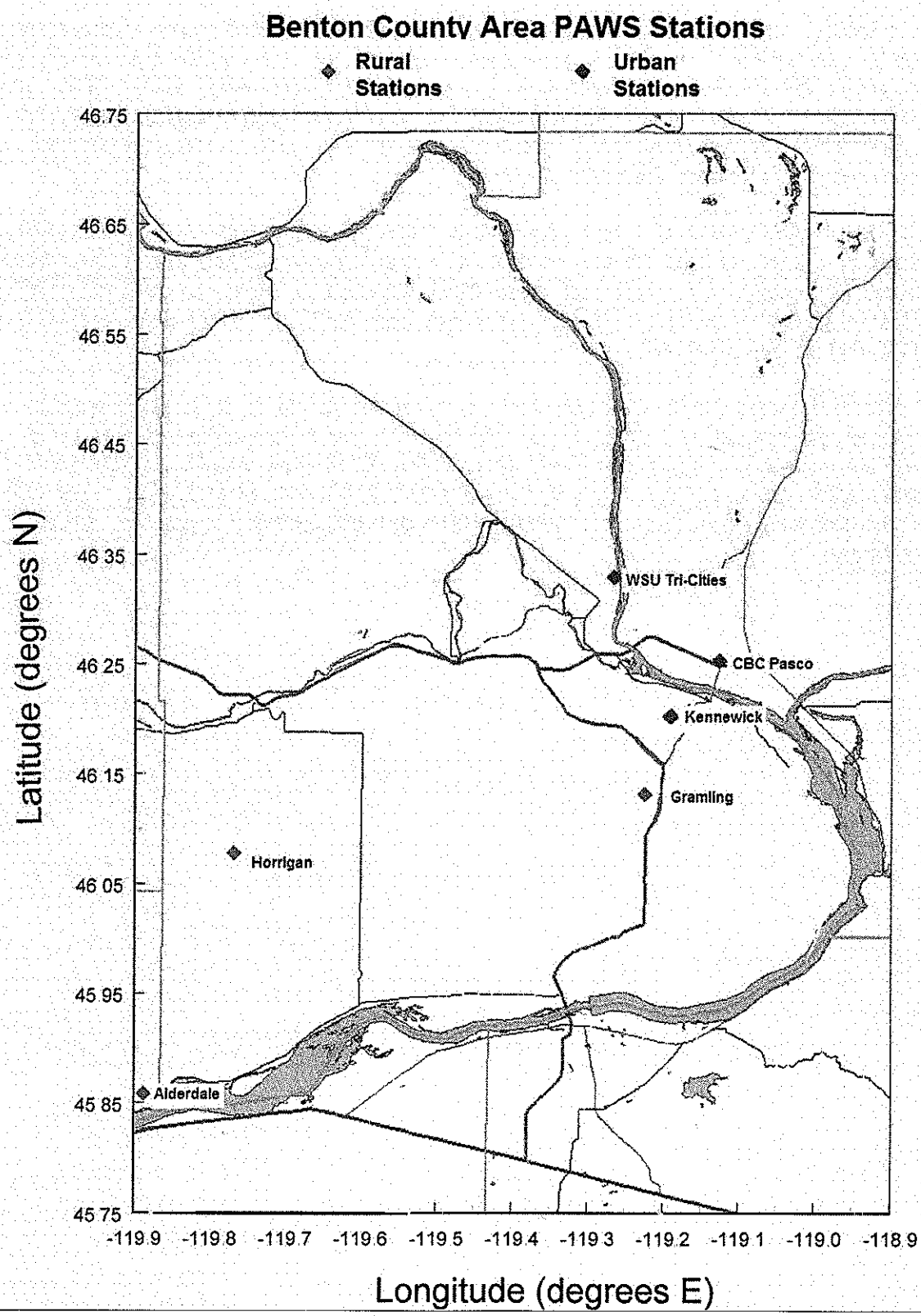


Table 2b: Rural Wind Data (2000 PST 28-Sep-2005 through 0000 PST 30-Sep-2005)

	Alderdale		**Horrigan**		**Gramling**	
Time	Wind Speed	Wind Direction	Wind Speed	Wind Direction	Wind Speed	Wind Direction
2000	9.74	225.496	3.22	257.127	11.85	199.459
2100	8.67	234.662	2.86	336.288	12.16	201.712
2200	8.18	203.963	3.40	23.894	10.59	201.212
2300	11.76	226.957	2.77	8.000	10.91	194.721
0000	11.80	211.096	2.81	12.734	11.44	200.215
0100	13.68	212.214	3.13	8.318	13.32	198.465
0200	17.66	226.707	2.45	10.723	11.89	196.720
0300	13.23	240.959	2.39	2.465	13.95	199.462
0400	15.25	228.962	5.14	3.142	13.82	185.961
0500	14.31	217.959	9.52	27.745	14.94	183.965
0600	13.41	215.959	12.43	18.228	14.58	191.718
0700	14.43	210.627	12.88	48.053	15.61	200.723
0800	14.67	211.460	7.91	172.734	20.66	210.210
0900	15.92	215.959	8.00	189.753	21.94	211.617
1000	17.89	224.958	12.79	192.711	22.81	218.459
1100	16.10	232.440	14.71	196.463	19.68	221.207
1200	11.00	247.453	18.87	210.211	16.90	223.707
1300	17.35	241.454	14.93	226.706	14.93	231.957
1400	16.45	248.271	6.93	219.209	13.90	221.458
1500	17.17	239.955	5.18	228.707	11.99	221.209
1600	19.50	258.451	6.53	233.706	12.70	225.957
1700	20.03	258.951	5.32	228.957	17.26	238.947
1800	23.07	248.453	5.99	233.956	19.32	232.211
1900	23.03	237.956	9.65	226.156	19.54	229.706
2000	20.39	238.953	10.42	232.706	18.69	228.707
2100	13.23	246.953	3.22	185.112	16.99	222.958
2200	11.18	228.457	2.86	182.756	17.98	228.207
2300	13.83	229.957	3.40	197.467	19.72	221.194
0000	14.13	237.955	2.77	233.297	14.13	215.980

Table 2c: Urban Wind Data (2000 PST 28-Sep-2005 through 0000 PST 30-Sep-2005)

	Kennewick		CBCPasco		WSU Tri-Cities	
Time	Wind Speed	Wind Direction	Wind Speed	Wind Direction	Wind Speed	Wind Direction
2000	5.38	199.600	2.37	221.705	2.44	84.600
2100	5.83	246.100	2.66	251.715	3.63	226.100
2200	4.64	255.100	1.69	175.462	.84	194.700
2300	2.47	216.000	1.83	193.134	.76	154.600
0000	5.08	235.100	3.04	239.733	1.57	184.500
0100	6.65	223.600	2.06	234.926	1.30	3.951
0200	6.06	200.700	3.80	240.943	1.44	60.180
0300	6.80	195.700	5.27	263.233	2.75	123.100
0400	6.72	199.400	4.91	269.699	1.83	187.400
0500	6.36	223.500	7.15	258.201	3.56	184.500
0600	7.07	252.000	7.55	264.950	6.97	184.300
0700	6.47	230.200	6.53	270.451	8.29	178.500
0800	9.01	221.100	6.61	270.447	10.61	180.300
0900	10.14	216.100	5.06	269.612	7.05	182.800
1000	9.92	223.100	8.27	266.952	6.39	175.300
1100	9.55	213.200	11.09	227.957	8.80	168.300
1200	9.48	223.300	10.59	230.957	13.44	174.400
1300	8.36	231.000	10.24	256.456	14.48	173.200
1400	6.06	234.100	6.30	242.622	13.69	174.300
1500	7.12	226.500	7.24	237.249	12.09	179.100
1600	8.02	240.500	12.43	241.955	17.78	182.700
1700	8.51	235.700	11.50	247.621	13.93	188.200
1800	10.31	237.400	10.28	234.802	12.22	192.400
1900	10.41	233.100	10.91	239.955	9.52	183.300
2000	12.29	229.500	13.14	249.453	14.91	180.100
2100	10.46	232.400	13.68	272.698	16.33	173.800
2200	10.70	226.700	10.33	264.700	13.86	177.200
2300	9.03	221.500	11.80	260.955	15.93	177.700
0000	7.18	222.000	10.51	261.449	18.86	176.500

Because of the increased topographical surface roughness in the urban area, the hourly wind speeds were lower than the speeds in the rural areas. These wind speeds were sufficient to support transport of PM_{10} across the urban area. In addition, the pattern of wind speeds and directions were consistent among four urban MET stations and were consistent with transport from the rural areas. Furthermore, because these wind speeds in the urban area were high enough to generate dust from construction sites with highly vulnerable soil surface conditions, urban fugitive dust was most likely a contributor to the exceedances.

As described, the necessary and sufficient conditions for wind conditions occurred on 29-Sep-2005 to cause an exceedance of the PM_{10} NAAQS at the Kennewick monitoring station in the Tri-Cities. Since there are many irrigated and dryland fields that are located relatively close to the Kennewick monitoring site (within 5-40 miles), the wind speeds and duration necessary to transport dust from the fields to the population center are relatively low. This close proximity of agricultural fields to the populated areas (and the PM_{10} SLAMS) makes the Tri-Cities distinct from other agricultural windblown dust situations, which typically have more remotely located source areas.

Direct Observational Information on the High Wind Event

The arid climate in the wheat-producing land in the areas to the southwest of the Tri-Cities makes fallow farming a necessary water harvesting method. In the fallow system, one-half the land is allowed to collect a year's amount of precipitation without growing wheat plants on that land. The other half of the land has actively growing wheat, which is using the moisture collected in the previous year's fallow land plus the current year's precipitation.

The exposed soils in fallow areas were potentially susceptible to wind erosion on 29-Sep-2005. The degree of susceptibility depended on the dryland wheat yields in the previous year, which determines the amount of straw residue available for holding the soil against the wind. The overall contribution from fallowed areas would also vary according to available surface residue left on the surface after field operations. The landscape stability of the rural PM_{10} source area on 29-Sep-2005 was sufficiently low to allow wind erosion with the combined effects of below-normal antecedent precipitation and necessary agricultural operations disturbing the soil.

Fallowed wheat fields were vulnerable because there is no crop to decrease wind speed at the soil surface below wind erosion threshold speeds and thus, they were subject to wind erosion and PM_{10} emissions. Sustained winds blowing across these unprotected and unstabilized soil surfaces cause soil particles to become airborne and transported into the Tri-Cities urban area even when BACM and BMP are being used. The saltation creep effect was clearly seen in several areas, as a number of the fields that were blowing were being impacted by the blowing dust and the movement of soil from adjacent fields. Fallow fields with sufficient residue from previous wheat harvest were also being subjected to high wind speeds. Harvested wheat fields and fallowed fields with good residue on 29-Sep-2005 were holding very well and exhibited little or no soil movement.

Windblown dust can come from construction sites at wind speeds substantially less than that needed to generate and transport dust from the agricultural areas to the urban areas. Based primarily upon direct observational evidence by BCAA staff and generally confirmed by the BCAA complaint records, often wind speeds of 5-10 mph can produce dust from extremely disturbed and vulnerable soil surfaces present on construction sites. On construction sites in and around the urban areas, extreme soil disturbance, an almost total lack of vegetative residue, and frequent mechanical activity make these construction sites vulnerable to wind erosion. On 29-Sep-2005, construction site dust may have contributed somewhat, but the data and our observations show that dust from agricultural areas was the dominant contributor.

Landscape Stability Conditions in the PM_{10} Source Area

The largest source area for PM_{10} in the 29-Sep-2005 event was the Horse Heaven Hills dryland wheat growing area and recently harvested potato fields. Precipitation and its effects on wheat culture are the principal determinants of landscape stability. Precipitation on an event time-scale can modify the susceptibility of the soil surface to particle detachment. Such precipitation effects are operative in the period of a few days prior to the wind event that causes the wind erosion. Recent precipitation within a few days prior to the wind event can suppress the amount of PM_{10} emissions and lack of precipitation could have the opposite effect. Sufficient precipitation can suppress emissions to the point that no exceedance occurs.

The months leading up to the exceedance date of 29-Sep-2005 had below normal precipitation recorded at the Hanford Area which is approximately 25 miles northwest of the Tri-Cities area. Although above average total precipitation is shown in Table A3 in Appendix A for the months March 2004 – September 2005, daily precipitation measurements from three Public Agricultural Weather System (PAWS) stations in rural Benton County and four (PAWS) stations in the urban agricultural areas Benton County showed no precipitation for 72 hours prior to the 29-Sep-2005 wind event. (Table 3). Therefore, bare soil and low precipitation in the months previous to September 2005 created below average residue areas, which are highly vulnerable to wind erosion, received no stabilizing effects of precipitation for two weeks before the wind event.

Table 3: Precipitation Prior to 29-Sep-2005 Exceedance

	Alderdale	Horrigan	Gramling	WSU TC	CBC Pasco	Badger Canyon	Kennewick
26-Sep-2005	0	0	0	0	0	0	0
27-Sep-2005	0	0	0	0	0	0	0
28-Sep-2005	0	0	0	0	0	0	0

Most likely, the largest sources of dust on 29-Sep-2005 were from fallowed dryland fields, preparation of seed beds for winter wheat planting, and irrigated potato fields disturbed by harvest. Winter wheat fields are particularly vulnerable to wind erosion during preparation for planting and following planting because of the disturbed soil condition. Any tillage that prepares the fields for planting and the planting operations themselves reduce surface residue. This reduction combined with an overall reduced supply of residue from low wheat yields in the previous crop cycle further increases susceptibility to wind erosion.

In summary, the combined effects of deficit and lack of rainfall for over 72 hours prior to 29-Sep-2005 resulted in a vulnerable unstable landscape that was susceptible to wind erosion when the 29-Sep-2005 wind event occurred.

Agricultural BACM Assessment

For agricultural sources, BACM is more commonly referred to as Best Management Practices (BMPs). A variety of management practices to control wind erosion and associated PM_{10} emissions were one of the expected outcomes of the Columbia Plateau PM_{10} Project. To qualify as a BMP, the practice must be proven to reduce wind erosion significantly below that which would occur with bare and tilled soil under similar weather conditions. Meteorological and climatological conditions strongly affect effective wind erosion or dust control on agricultural lands. Maintaining soil stability on agricultural fields is a problem in the Tri-Cities region principally during the most vulnerable times, such as crop planting and harvesting, or for other tillage operations that leave the soil vulnerable to wind erosion.

In the 2004 Annual Status Report regarding Best Available Control Measures (BACM) implementation shows the level of Conservation Reserve Program (CRP) and Best Management Practice use has increased from 70 to 78 percent in the priority counties of the Columbia Plateau. Seventy nine percent of the total farmable acres in all counties of the Columbia Plateau NEAP are now part of a United States Department of Agriculture (USDA) conservation program, use on of the minimum till practices, or contain 15-30% residue. Washington State found that BACM is implemented throughout the Columbia Plateau, which includes Benton County. Based on this evaluation, Washington State views these levels of wind erosion control as sufficient to fulfill BACM criterion of the Natural Events Policy. A more detailed discussion can be found in Appendix A.

SUMMARY AND CONCLUSIONS

From the evidence presented, the following conclusions can be drawn:

1. The Tri-Cities area and outlying agricultural areas were subjected to high wind speeds on 29-Sep-2005.

2. The urban and rural PM_{10} source areas meet the wind data standard of [18+2] miles per hour for two or more hours.

3. Agricultural fields, which were highly susceptible to wind erosion during the 18-Mar- 2004 wind events, included fallowed wheat fields and recently harvested potato fields with insufficient crop residue were blowing most severely.

4. The combination of the wind event, which had the necessary wind speed, duration, and direction to generate and transport PM_{10}, and the vulnerable landscape, caused the 29-Sep-2005 exceedance. Although the agricultural fields have BACM applied, there were certain conditions present including reduced residue due to extended drought that allowed the wind to overcome BACM. In addition, any unprotected area of soil surface at construction sites or elsewhere in the landscape would have had potential to contribute to the exceedance.

5. In light of the previous statements and the acknowledgment that the Horse Heaven Hills, in general, highly susceptible to high wind events, show that windblown dust is the most probable source of the PM_{10}.

6. Based upon these conclusions, the BCAA considers the PM_{10} concentration recorded on 29-Sep-2005 to have been caused by a high wind natural event, with winds that met the Washington State's definition of a high wind event, and requests that the data for this date be flagged as such in the AIRS database.

ABBREVIATIONS AND ACRONYMS

BACM	Best Available Control Measures
BMP	Best Management Practices
SLAMS	State and Local Air Monitoring Station
EPA	U.S. Environmental Protection Agency
BCAA	Benton Clean Air Authority
BFWWCAPCA	Benton Franklin Walla Walla Counties Air Pollution Control Authority, renamed BCAA in 1995
MET	Meteorological
NAAQS	National Ambient Air Quality Standard
PM_{10}	Particulate Matter, 10 microns in diameter
Ecology	Washington State Department of Ecology
PST	Pacific Standard Time
NEP	Natural Events Policy
NEAP	Natural Event Action Plan
MOA	Memorandum of Agreement
RACM	Reasonably Available Control Measures
FDP	BCAA Fugitive Dust Policy
HMN	Hanford Meteorological Network
PAWS	Public Agricultural Weather System operated by Washington State University
CFR	U.S. Code of Federal Regulations

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APPENDICIES

Appendix A

Table A1: Daily PM_{10} Concentration (ug/m^3) for 2004

STATION:	KENNEWICK, WSC				POLLUTANT:					PM10			YEAR:		2004
SITE #:	0340003J				POLLUTANT CODE:					81102			DECIMAL POS.:		0
PROJECT	1				METHOD:					83			UNITS:		µg/m³

CA	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	MAX	MEAN	NO
1	16	7		13	32	17	25	28	91	43	24	19	**28.5**	**91.0**	**11**
2	10		13	19	36		48		15	36	14	17	**23.1**	**48.0**	**9**
3	16	9	11	17		30	15	34	22	32	10	17	**19.4**	**34.0**	**11**
4	24	20	6	22		32	17	29	45	44	23	15	**25.2**	**45.0**	**11**
5	40	27	30	23	31	19		10	17	46	29	10	**25.6**	**46.0**	**11**
6	14	17	10	32	25	18	20	15	22	24	39	10	**20.3**	**39.0**	**12**
7	17	15	14	23	33	11	22	8		22	36	4	**18.6**	**36.0**	**11**
8	30	17	20	17	14	6	22	14	85	27		3	**23.2**	**85.0**	**11**
9	50	20	22	25	7	8	30		17	8	38	10	**21.4**	**50.0**	**11**
10	44	23	30	29	19	11	20	34	22		39		**27.1**	**44.0**	**10**
11	40	20	23	25	7	7	12	31			24	4	**19.3**	**40.0**	**10**
12	15	16	19		7	8	29	38	15		21	2	**17.0**	**38.0**	**10**
13	16	25	14	17	15	15	37	48	14	23	25	1	**20.8**	**48.0**	**12**
14	23	29	7	7	22	11	45	54	18	29	23	8	**23.0**	**54.0**	**12**
15	23	22		8	20	12	41	30	46	26	30	8	**24.2**	**46.0**	**11**
16	10	12	19	4	8	21	31	36	20	16	18	23	**18.2**	**36.0**	**12**
17	17	12	19	7		29	39	35	8	10	15	23	**19.5**	**39.0**	**11**
18	19	13	301	7		20	47	35	15		17	16	**49.0**	**301.0**	**10**
19	13	13	22	12	17	17		55	8	12		12	**18.1**	**55.0**	**10**
20	20	15	25	6	15	17	20	35	12	13	12	10	**16.7**	**35.0**	**12**
21	21	19		7	26		19	62	17		76	13	**28.9**	**76.0**	**9**
22	31	14		10	14	31	36	5	36		26	24	**22.7**	**36.0**	**10**
23	20		64		5	45	34	11	29	11	32	20	**27.1**	**64.0**	**10**
24	9	15	44		10	51	31	22	30	7	24	22	**24.1**	**51.0**	**11**
25	4	9	14		20	44	41	19	27	15	10	19	**20.2**	**44.0**	**11**
26	8	9	7		17	24	32	6	27	20	7		**15.5**	**32.0**	**10**
27	15	7	15	539	7	17	45	8		22	13		**68.8**	**539.0**	**10**
28		7	10	33	29	27	54	12	43	29		12	**25.6**	**54.0**	**10**
29	5	9	19	28		50	39	14	36	16		11	**22.7**	**50.0**	**10**
30	22		30	31	21	25	32		31	61	25	13	**29.1**	**61.0**	**10**
31			9							12		13	**11.3**	**13.0**	**3**
AVG	**20.3**	**15.6**	**30.3**	**38.4**	**18.3**	**22.2**	**31.5**	**26.9**	**28.4**	**24.2**	**25.0**	**12.8**	**24.4**		
MAX	**50.0**	**29.0**	**301.0**	**539.0**	**36.0**	**51.0**	**54.0**	**62.0**	**91.0**	**61.0**	**76.0**	**24.0**		**539.0**	
DAYS	**29.0**	**27.0**	**27.0**	**25.0**	**25.0**	**28.0**	**28.0**	**27.0**	**27.0**	**25.0**	**26.0**	**28.0**			**322**

Table A2: Daily PM_{10} Concentration (ug/m^3) for 2005

STATION:	KENNEWICK, VSC	POLLUTANT:	PM10	YEAR:	2005
SITE #:	0340003J	POLLUTANT CODE:	81102	DECIMAL POS.:	0
PROJECT	1	METHOD:	63	UNITS:	µg/m³

CA	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	MAX	MEAN	NO
1			16	42	23		28		26				27.0	42.0	5
2			22		21	32	27	23	32				26.2	32.0	6
3	10	27	20	12	18	26	14	35					20.3	35.0	8
4	10	37	26	9	10	20		38	19				21.1	38.0	8
5	17	42	16	12		17		42					24.3	42.0	6
6	22	40	14	17	23	9	66	36	27				28.2	66.0	9
7	14	3	25	112	11	23	25	23	34				30.0	112.0	9
8	9	5	17	12	14	13	65	35	37				23.0	65.0	9
9	7		23	20		16	10	31	65				24.6	65.0	7
10	8	28	25	14	8	24	11	43	13				19.3	43.0	9
11	8	22	32	23	16	31	14	42	12				22.2	42.0	9
12	6	28	33	21	14	10	18	590	22				82.4	590.0	9
13	10	26	15	12	25	18	16	39	21				20.2	39.0	9
14	10	24		21	13	19	22	32	25				20.8	32.0	8
15	12	5	41	20	15	20	36		27				22.0	41.0	8
16	9	11	205	15	9	38	18	95					50.0	205.0	8
17	19	16	10	11	11	9	14	34	11				15.0	34.0	9
18	24	21	16	9	11	10		20	13				15.5	24.0	8
19	18		9	19		12	25	36	25				20.6	36.0	7
20	16	27	12	20	9		25	43	21				21.9	43.0	8
21	19	31	12	15	8	60	31	33	22				25.7	60.0	9
22	19	19	11	18	12	31	48		24				22.8	48.0	8
23	22	24	18	20	12	15	15		22				18.5	24.0	8
24	11	35	12	10	13	26	16	21	18				18.0	35.0	9
25	16	35	12	11	17	17	22	33	20				20.3	35.0	9
26	25		13	16	19	28	29	38	38				25.8	38.0	8
27	18	46	4	101	25	13	34	24	30				32.8	101.0	9
28	15	52	46	22			41	24	50				35.7	52.0	7
29	16	28	98	24	39	14	27		268				64.3	268.0	8
30	5	23	13	14	37	32	25	15					20.5	37.0	8
31	24						30	20					24.7	30.0	3
AVG	14.5	26.2	28.1	23.2	16.7	21.6	26.9	55.6	35.5	--	--	--	27.3		
MAX	25.0	52.0	205.0	112.0	39.0	60.0	66.0	590.0	268.0	--	--	--		590.0	
DAYS	29.0	25.0	29.0	29.0	26.0	27.0	28.0	26.0	26.0	0.0	0.0	0.0			245

Table A3: Hanford Precipitation Data (3-1-2004 through 9-29-2005)

[1] Total precipitation before exceedance date of 3-18-2004

	Actual (in.)	Normal (in.)	Difference (in.)
March-04	0.36	0.58	-0.22
April-04	0.21	0.44	-0.23
May-04	0.89	0.55	0.34
June-04	0.82	0.41	0.41
July-04	0.03	0.28	-0.25
August-04	0.95	0.27	0.68
September-04	0.14	0.33	-0.19
October-04	0.86	0.59	0.27
November-04	0.29	0.98	-0.69
December-04	0.37	1.11	-0.74
January-05	0.93	0.87	0.06
February-05	0.04	0.68	-0.64
March-05	0.31	0.58	-0.27
April-05	0.26	0.44	-0.18
May-05	0.79	0.55	0.24
June-05	0.06	0.41	-0.35
July-05	0.09	0.28	-0.18
August-05	0.06	0.27	-0.21
September-05[1]	0.66	0.33	0.33
Totals (Mar '04-Sep '05)	8.12	9.95	-1.82

Appendix B
2004 Best Available Control Measures for Columbia Plateau Agriculture

Summary

This report fulfills Ecology's commitment to review and report annually on the use of Best Available Control Measures (BACM) in the Columbia Plateau. Ecology committed to provide such a report to the Environmental Protection Agency (EPA) in the revised Natural Events Action Plan (NEAP).

The level of Conservation Reserve Program (CRP) and Best Management Practice (BMP) use have increased from 70 to 78 percent in the priority counties of the Columbia Plateau. Seventy eight percent of the total farmable acres in these counties are now part of a United States Department of Agriculture (USDA) conservation program, use one of the minimum till practices, or contain 15-30% residue. Washington State finds this level of CRP and BMP implementation easily fulfills BACM criteria.

Background

EPA issued the policy on "Areas Affected by PM-10 Natural Events", or the Natural Events Policy (NEP), on May 30, 1996. Under the NEP, ambient PM_{10} concentrations raised by unusually high winds may be treated as uncontrollable natural events when the dust originates from nonanthropogenic sources, or when the dust originates from contributing anthropogenic sources controlled with BACM. After natural events cause the PM_{10} concentration to violate the PM_{10} National Ambient Air Quality Standard, the NEP allows a state to develop a natural events action plan (NEAP) to deal with future exceedances.

A number of exceedances of the 24-hour standard for PM_{10} were recorded in eastern Washington in the late 1980*s* and early 1990*s*. Examination of the exceedances showed a close correlation to high wind events and upwind agricultural fields were identified as the chief source of the wind-blown dust. The Washington State Department of Ecology (Ecology) developed the *Natural Events Action Plan for High Wind Events in the Columbia Plateau* in March 1998, and submitted it to Region 10 EPA, in accordance with the NEP.

The 1998 NEAP included Ecology's commitment to re-evaluate the NEAP at the end of 2001. The 2001 evaluation is embodied in the revised NEAP submitted to EPA in July, 2003. Several changes were incorporated into the revised NEAP including Ecology's commitment to review and report to EPA annual BACM implementation.

BACM Definition and Tracking Mechanism

The revised NEAP defines BACM for agricultural fields as USDA Conservation Title Programs supplemented by incentive based implementation of wind erosion conservation practices or BMPs. In short, the BACM definition recognizes the critical

role of agricultural agencies in defining and instituting BACM on the Columbia Plateau. The primary agencies include those directly reporting to the USDA such as the Natural Resources Conservation Service (NRCS), the Farm Service Agency (FSA), and the Agricultural Research Service (ARS). Additional agricultural agencies include the Washington State Conservation Commission, local Conservation Districts and various agriculture related departments of the Washington State University. The NEAP acknowledges the combined expertise of these agencies and relies on the various programs of these agencies in implementing the conservation practices that constitute BACM.

For defining BACM, the NEAP uses the USDA's CRP program and the wind erosion BMPs encouraged by the NRCS and/or the Columbia Plateau Wind Erosion /Air Quality Project (referred to as the CP3). Use of these practices is tracked by the Conservation Technology Information Center's (CTIC), Core 4 program. The CTIC's Core 4 program tracks conservation tillage (No-Till, Ridge-Till, Mulch-Till) and conventional tillage (0-15% and 15-30% residue) practices and CRP enrollment on a county by county basis.

A full discussion on Ecology's BACM definition and tracking mechanism is found in the revised NEAP.

STATUS REPORT: 2004 BACM

The 2003 NEAP determined BACM is implemented in the Columbia Plateau based on 68 percent use of conservation practices. Attachment 1 shows the implementation of conservation practices for the seven priority counties, as defined in the NEAP. These counties have the lowest rainfall and thus are the most susceptible to windblown dust.

Data evaluated is for the year 2004. The evaluation includes data on CRP, minimum tillage, and residue remaining on the field for the lowest rainfall counties of the Columbia Plateau - counties Ecology finds to be high priority in terms of addressing wind blown dust. Ecology identified Adams, Douglas, Franklin, Grant and Lincoln as priority counties in the 1998 NEAP. Benton and Walla Walla counties were added to the list more recently. The Core 4 data shows 78 percent of the priority counties' total farmable acres are in a USDA conservation program, use one of the minimum till practices, or contain 15-30% residue.

Similarly, attachment 2 shows the implementation of conservation practices for all counties of the Columbia Plateau NEAP. The data shows 79 percent use of conservation practices throughout the Columbia Plateau.

The results are consistent with the 2003 NEAP determination and show that we continue to meet BACM requirements.

Additional Efforts to Enhance Wind Erosion Conservation Measures

Ecology continues to work with the various agricultural agencies to enhance the use of conservation practices in the Columbia Plateau. In doing so, implementation of wind erosion conservation measures is enhanced beyond that tracked and reported by the Core 4.

Enhancing Wind Erosion Conservation Measures in Priority Counties of the Columbia Plateau:

Ecology completed a contract with the Benton Conservation District (BCD) for tasks associated with a special funds grant from the EPA. The project a) provided immediate, temporary treatment to critical areas and, b) promoted conservation buffers as options for longer-term or permanent wind erosion control measures. Results of the grant include the following:

1.) To date, 14 different farm operations used the straw mulcher to apply roughly 771 tons of grass straw to about 520 acres of "hot spots" (highly erodible areas). An additional 300 tons was applied without project-supplied cost-share straw. In total, over 1000 tons of straw were applied to highly erodible areas in an effort to protect against the occurrence of windblown dust. Even though all the cost-share money for this project has been expended, several growers have shown continued interest in using the straw mulcher.

2.) The BCD, USDA-Natural Resources Conservation Service, Ecology, and the Benton Clean Air Authority conducted an education and outreach program that focused on wind erosion conservation buffers as a longer-term solution to wind erosion. Material covered included the Natural Events Policy, Washington's Natural Events Action Plan and the importance of implementing Best Available Control Measures. The meeting was attended by thirty state natural resource agency staff and dryland wheat growers from the Horse Heaven Hills. The effort was an adjunct to a three-day technical workshop (May 17-20, 2004) that focused on implementing wind erosion conservation measures in the Columbia Plateau. The NRCS supplemented funds from this grant to conduct the workshop. The attached news release announcing the spring 2004 workshop was published in the Tri-City Herald and the Spokesman Review.

Numerous growers responded favorably to implementing conservation buffers on a trail basis. Ecology, the BCD and EPA will develop a grant to facilitate such an effort in the spring of 2005.

3.) Dryland growers also encouraged the agencies involved with this grant to consider advocating for increased CRP eligibility in the HHHs. In November, 2002, the BCAA, the BCD and others wrote letters to the Washington State FSA regarding CRP eligibility in the HHH. The BCAA expressed their view that the HHH dryland wheat region should receive greater consideration as an air quality conservation priority area for the purpose of CRP eligibility. In support of their view, the BCAA points to air quality concerns due to windblown dust impacting the Tri-Cities and the Wallula, Washington areas and the

HHH as an identified source area. Ecology's Air Quality Program wrote to the FSA, as well, supporting BCAA's position.

Prior to this grant (06/2002), roughly 74,000 acres were enrolled in the USDA CRP. As of the most recent enrollment (12/2004), over 120,000 acres were enrolled – of which – 108,000 acres are in the HHHs. The most recent signup took Benton County up to the federally mandated county limit that allows no more than 25% of eligible cropland in CRP. As a result, numerous growers wanting to enroll cropland were turned away.

4.) Staff from the BCD, the NRCS, Ecology's AQ Program and several dryland growers from the HHHs participated in NRCS's local work group process regarding criteria and eligibility for EQIP funding. These levels of involvement lead directly to the following changes in criteria and eligibility that will facilitate increased implementation of wind erosion conservation measures in the HHHs.

- Air quality is elevated as a natural resource concern – now second only to water quality.

- Dryland farmers/air quality projects no longer must compete against ALL resources concerns identified in the three-county workgroup. The initial screening/funding phase will only consider dryland farmers/air quality projects competing directly with one another.

- Criteria for air quality projects now includes increased points for projects that include:

    - No-Till (applicant gets more points for this(52) than direct seed (42) and mulch till (32)), and
    - Full season chemical fallow.

- bonus points are awarded for projects that include buffers and/or involve a pool of contiguous/adjacent landowners.

As evidenced above, this grant was tremendously successful. The quantitative outcomes are discussed in large part above. Moreover, this multi-agency effort significantly raised awareness regarding windblown dust and the critical importance of implementing appropriate controls to reduce emissions. To this end, both the growers and the agencies involved with this grant are willing and anxious to continue such efforts. Numerous growers are willing to install long-term (10 years to permanent) wind erosion buffers if funding support is available. The BCD and Ecology look forward to supporting their interest via additional EPA grant funds.

Additional Ecology Grants:

As presented in the 2003 Best Available Control Measures Status Report, Ecology's Water Quality Program is funding two projects that enhance wind erosion control

measures on the Columbia Plateau. The objectives of both water and wind erosion control are to prevent or minimize soil particle detachment and entrainment by the medium (air or water.) Consequently, conservation practices to reduce the effects from both types of erosion are substantially similar. For this reason, air quality is improved when conservation measures to reduce water erosion are increased.

Both the Spokane Conservation District *Conservation Tillage Program* and the Franklin Conservation District *Wheat Erosion Buffer Program* continue. Additional details regarding these two programs are found in the 2003 Best Available Control Measures Status Report and at http://www.sccd.org/sccd/productionag/.

The Conservation Security Program and the Moses Coulee Watershed:

The Farm Security and Rural Investment Act of 2002 (2002 Farm Bill) amended the Food Security Act of 1985 to authorize the Conservation Security Program (CSP). The CSP is a voluntary program administered by USDA's Natural Resources Conservation Service (NRCS). It is designed to support on-going stewardship of private agriculture lands by providing payments for maintaining and enhancing natural resources. CSP identifies and rewards growers who are meeting the highest standards of conservation and environmental management on their operation.

Nationally, eighteen watersheds were selected to participate in the CSP in 2004 – one of which is the Moses Coulee Watershed. Located in Central Washington, the Moses Coulee includes portions of both Douglas and Grant counties. Eligible growers that apply and are selected will receive funding support to maintain and enhance conservation management practices on their operations. NRCS reports that air quality management practices are among the most important practices targeted for enhancement in the Moses Coulee through the CSP. Additional information regarding the CSP and the Moses Coulee Watershed are attached.

Conclusion

Ecology and the identified agricultural agencies continue to carry out the Columbia Plateau NEAP. Ecology finds the level of CRP and BMP implementation identified in this report continues to fulfill BACM criteria. Ecology will continue to document natural events and flag exceedances when justified under the terms of the 2003 NEAP.
1) To date, 14 different farm operations used the straw mulcher to apply roughly 771 tons of grass straw to about 520 acres of "hot spots" (highly erodible areas). An additional 300 tons was applied without project-supplied cost-share straw. In total, over 1000 tons of straw were applied to highly erodible areas in an effort to protect against the occurrence of windblown dust. Even though all the cost-share money for this project has been expended, several growers have shown continued interest in using the straw mulcher.

2). The BCD, USDA-Natural Resources Conservation Service, Ecology, and the Benton Clean Air Authority conducted an education and outreach program that focused on wind

erosion conservation buffers as a longer–term solution to wind erosion > Material covered included the Natural Events Policy, Washington's Natural events Action Plan and the importance of implementing BACM. The meeting was attended by thirty state natural resource agency staff and dryland wheat growers from the Horse Heaven Hills. The effort was an adjunct to a three-day technical workshop (May 17-20, 2004) that focused on implementing wind erosion conservation measures in the Columbia Plateau. The NRCS supplemented funds from this grant to conduct the workshop. Numerous growers responded favorably to implementing conservation buffers on a trial basis. Ecology, the BCD and EPA will develop a grant to facilitate such an effort in the spring of 2005.

3). Dryland growers also encouraged the agencies involved with this grant to consider advocating for increased CRP eligibility in the HHHs. In November, 2002 the BCAA, the BCD and others wrote letters to the Washington State FSA regarding CRP eligibility in the HHH. The BCAA expressed their view that the HHH dryland wheat region should receive greater consideration as an air quality conservation priority area for the purpose of CRP eligibility. In support of their view, the BCAA points to air quality concerns due to windblown dust impacting the Tri-Cities and the Wallula, Washington areas and the HHH as an identified source area. Ecology's Air Quality Program wrote to the Farm Service Agency (FSA), as well, supporting BCAA's position.

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4). Staff from the BCD, the National Resources Conservation Service (NRCS), Ecology's AQ Program and several dryland growers from the HHHs participated in the NRCS's local work group process regarding criteria and eligibility for EQIP funding. These levels of involvement lead directly to the following changes in criteria and eligibility that will facilitate increased implementation of wind erosion conservation measures in the HHHs.

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- Dryland farmers/air quality projects no longer must compete against ALL resources concerns identified in the three-county workgroup. The initial screening/funding phase will only consider dryland farmers/air quality projects competing directly with one another.
- Criteria for air quality projects now includes increased points for projects that include:

    - No-Till (applicant gets more points for this (52) than direct seed (42) and mulch till (32) and

- full season chemical fallow.

- Bonus points are awarded for projects that include buffers and/or involve a pool of contiguous/adjacent landowners.

As evidenced above, this grant was tremendously successful. Moreover, this multi-agency effort significantly raised awareness regarding windblown dust and the critical importance of implementing appropriate controls to reduce emissions. Both the growers and the agencies involved with this grant are willing and anxious to continue such efforts. Numerous growers are willing to install long-term (10 years to permanent) wind erosion buffers if funding support is available.

Other additional grants include Ecology's Water Quality Program that is funding two projects that enhance wind erosion control measures on the Columbia Plateau. The objectives of both water and wind erosion control are to prevent or minimize soil particle detachment and entrainment by the medium (air or water). Consequently, conservation practices to reduce the effects from both types of erosion are substantially similar. For this reason, air quality is improved when conservation measures to reduce water erosion are increased.

The BCAA continues to carry out the Columbia Plateau NEAP. The BCAA finds the level of CRP and BMP implementation identified in this report continues to fulfill BACM criteria. Ecology will continue to document natural events and flag exceedances when justified under the terms of the 2003 NEAP.

Past Weather Conditions for HVSTA

Observations prior to selected time: September 30, 2005 - 00:00 PDT

Weather Conditions at September 30, 2005 - 0:00 PDT

	0:00	24 Hour Max	24 Hour Min
Temperature	73.0° F	77.0 at 16:45	65.0 at 5:00
Wind Speed	16 mph from SW	21 at 11:15	3 at 0:45
Wind Gust	30 mph	39 at 19:00	9 at 0:00

Tabular Listing: September 29, 2005 - 0:00 through September 30, 2005 - 00:00 PDT

Time(PDT)	Temperature °F	Wind Speed mph	Wind Gust mph	Wind Direction	Quality check
0:00	73.0	16	30	SW	OK
23:45	73.0	20	37	SW	OK
23:15	74.0	16	31	SW	OK
23:00	73.0	16	30	SW	OK
22:45	73.0	18	26	SW	OK
22:15	74.0	14	25	SW	OK
22:00	74.0	15	26	SW	OK
21:45	74.0	17	28	WSW	OK
21:15	74.0	16	25	SW	OK
21:00	75.0	15	26	SW	OK
20:45	75.0	20	33	SW	OK
20:15	75.0	21	29	SW	OK
20:00	75.0	20	29	SW	OK
19:45	75.0	17	26	SW	OK
19:15	75.0	17	31	WSW	OK
19:00	76.0	20	39	WSW	OK
18:45	76.0	17	35	WSW	OK
18:15	76.0	20	37	WSW	OK
18:00	76.0	20	35	WSW	OK
17:45	76.0	16	33	WSW	OK
17:15	77.0	15	26	SW	OK
17:00	77.0	16	28	WSW	OK
16:45	77.0	16	26	WSW	OK
16:15	76.0	17	26	SW	OK
16:00	75.0	13	26	SW	OK
15:45	74.0	12	22	SW	OK
15:15	73.0	12	20	SW	OK
15:00	73.0	12	18	SW	OK
14:45	73.0	13	20	SW	OK
14:15	74.0	13	21	WSW	OK
14:00	74.0	14	23	WSW	OK
13:45	75.0	16	28	SW	OK
13:15	75.0	17	28	SW	OK
13:00	75.0	17	28	WSW	OK
12:45	75.0	20	32	SW	OK

12:15	75.0	20	35	SW	OK
12:00	75.0	18	26	SW	OK
11:45	75.0	18	33	SW	OK
11:15	74.0	21	35	SW	OK
11:00	74.0	20	35	SW	OK
10:45	73.0	18	33	SW	OK
10:15	73.0	18	30	SW	OK
10:00	73.0	18	30	SW	OK
9:45	72.0	20	31	SW	OK
9:15	70.0	17	31	SW	OK
9:00	70.0	16	29	SW	OK
8:45	70.0	17	28	SW	OK
8:15	68.0	12	22	WSW	OK
8:00	67.0	10	16	SW	OK
7:45	67.0	10	20	SW	OK
7:15	66.0	13	26	SW	OK
7:00	66.0	13	23	SW	OK
6:45	66.0	10	17	SW	OK
6:15	66.0	17	29	SW	OK
6:00	65.0	16	26	SW	OK
5:45	66.0	17	26	SW	OK
5:15	65.0	14	21	SW	OK
5:00	65.0	15	25	SSW	OK
4:45	66.0	16	25	SSW	OK
4:15	66.0	15	24	SW	OK
4:00	66.0	17	26	SSW	OK
3:45	66.0	15	28	SSW	OK
3:15	67.0	15	26	SW	OK
3:00	67.0	12	18	SW	OK
2:45	67.0	12	18	SW	OK
2:15	67.0	10	20	SW	OK
2:00	67.0	10	17	SW	OK
1:45	67.0	13	23	SW	OK
1:15	67.0	10	20	SW	OK
0:45	66.0	3	9	WSW	OK
0:15	66.0	5	10	SW	OK
0:00	66.0	5	9	SSW	OK
23:45	65.0	3	8	S	OK
23:15	66.0	3	8	SSW	OK
23:00	66.0	3	5	NE	OK

from 7:45 - 12:45
WS from 18 - 21 mph
gust from 26 - 35 mph